

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

MA 1st Semester Examination, 2015

Subject-Economics

MEC/MAEC 03-Mathematical Methods for Economic Analysis

Time: 3 hours

Maximum marks: 80

The figures in the margin indicate full marks for the questions

- 1 *Answer any five questions from the following* 2×5=10 *
(Answer in around 50 words)
- a Define square matrix.
 - b If $y = e^{ax}$, find out $\frac{dy}{dx}$
 - c Given $y = f(x_1, x_2) = 2x_1^2 + x_1x_2 + 3x_2^2$, find out $\frac{dy}{dx_1}$ and $\frac{dy}{dx_2}$
 - d What is global maximum?
 - e If $y = f(x_1, x_2)$, state the conditions of minima.
 - f Given $u = u(x, y)$ subject to $B = xp_x + yp_y$, construct the lagrange function.
 - g Find $\int dx$.
- 2 *Write any three short notes from the following* 4×3=12
(Answer in around 150 words)
- a Given the price equation $P=100-2Q$ where Q is the quality demanded, find the marginal revenue if $Q=10$.
 - b Prove that Cobb-Douglas production function satisfies the Euler's theorem when $(\alpha+\beta)=1$.
 - c Find out the output at which the average cost is minimum from the total cost function-
$$TC=2Q^2+5Q+18$$

- d Find the extreme values of the following function and determine whether they are maxima or minima.

$$Y = 5x_1^2 + 2x_2^2 - 2x_1x_2 - 15x_1 - 6x_2$$

- e Find :

$$\int \frac{6x+3}{x(x+1)} dx$$

- 3 Answer any three questions from the following 6×3=18

(Answer in around 250 words)

- a Find the Inverse of

$$A = \begin{bmatrix} 4 & 0 & 1 \\ 3 & 2 & 1 \\ 1 & 5 & 2 \end{bmatrix}$$

- b (i) If $y = (5+2x^2)(3x+4x^2)$, find $\frac{dy}{dx}$.
 (ii) Find out the marginal revenue function (MR) given the average revenue function $AR = 10 - 0.5q$.
- c In a perfectly competitive market, the total revenue and total cost of a firm given by
 $R=20q$ and $C=q^2+4q+20$
 Find profit maximizing output and maximum profit.
- d Derive the aggregate saving function $S(Y)$ if the marginal propensity to save function is given by-
 $MPS = S'(Y) = 1 - \frac{0.2}{\sqrt{Y}}$ and if aggregate saving is zero when income is 144.
- e Solve the equation-
 $\frac{dy}{dx} + 5y = 10$
 with the initial condition $y(0) = 6$.

- 4 Answer any four questions from the following 10×4=40
 (Answer in around 500 words)

- a Use Cramer's rule to solve the following simultaneous equation-

$$2x_1 - x_2 + 3x_3 = 9$$

$$x_1 + 3x_2 + 2x_3 = 13$$

$$2x_1 + 2x_2 + x_3 = 9$$

- b (i) Establish relationship between Average Cost (AC) and Marginal Cost (MC) by using product or quotient rule of differentiation.
 (ii) Given the total cost function-
 $C = 10000 + 100q - 10q^2 + \frac{1}{3}q^3$
 find the output at which marginal cost is equal to average variable cost.
- c The demand functions of a monopoly in two different markets are given by-

$$P_1 = 53 - 4Q_1$$

$$P_2 = 29 - 3Q_2$$

- and the total cost function is $C = 20 + 5Q$ where P_1 and P_2 are prices and Q_1 and Q_2 are the outputs in Market I and Market II respectively such that $Q = Q_1 + Q_2$.
 Find (i) Profit maximizing output to be sold in first and second markets, (ii) equilibrium prices of two markets, (iii) maximum profit.
- d (i) Maximize a function $y = 5x_1x_2$ subject to $x_1+2x_2 = 8$.
 (ii) The marginal revenue function is given by $MR = R'(Q) = 50 - 4Q$. Find point elasticity of demand when $Q = 10$.
- e Given the utility function $U = 2 + x + 2y + xy$ and the budget constraint $4x + 6y = 94$, find out equilibrium purchase of x and y in order to maximize total utility.

f (i) Solve $\frac{dy}{dx} + 4x^3y = 0$.

(ii) Net investment flow is given by-

$I(t) = 4\sqrt{t}$. If initial capital stock is $k(0)$ then find capital stock at time t . Also find the capital formation during the period first year to fourth year.